

In re Application of:
Frudakis and Shriver
Application No.: 10/644,594
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Attorney Docket No.: DNA1170-2

Amendments to the Claims

Please amend claims 1, 24, 31, 39-42, 45, 48, 50-51, 53-54 and 56-57 as indicated in the listing of claims.

Please cancel claims 2, 7, 10-11, 13-14, 17-20, 23, 25-28, 33-36, 38, 46 and 59-82 without prejudice or disclaimer.

The listing of claims will replace all prior versions, and listings of claims in the application:

Listing of Claims:

1. (Currently Amended) A method of inferring, ~~with a predetermined level of confidence,~~ a trait of an individual, comprising:

a) ~~contacting a sample comprising nucleic acid molecules of a test individual with hybridizing oligonucleotides,~~

wherein the hybridizing nucleotides can detecting, in a nucleic acid sample from an individual, nucleotide occurrences of single nucleotide polymorphisms (SNPs) of in a panel of at least about ten ancestry informative markers (AIMs), wherein the nucleotide occurrences of the SNPs are indicative of a population structure, wherein the population structure is correlated with the a trait of the individual, and wherein the panel comprises at least one AIM that is not linked to a gene linked to the trait, and

~~wherein said contacting is performed under conditions suitable for detecting the nucleotide occurrences of the AIMs of the test individual by the hybridizing oligonucleotides; and~~

b) ~~identifying with a predetermined level of confidence, a the population structure that correlates indicated by~~ with the nucleotide occurrences of the SNPs ~~AIMs detected in~~

the ~~test individual of step a)~~, wherein identifying the population structure ~~correlates~~
~~with~~infers a ~~the~~ trait,

thereby inferring, ~~with a predetermined level of confidence~~, the trait of the individual.

2. (Cancelled)

3. (Original) The method of claim 1, wherein the trait comprises biogeographical
ancestry (BGA).

4. (Original) The method of claim 3, wherein the panel comprises AIMs set forth as
SEQ ID NOS:1 to 331.

5. (Original) The method of claim 3, wherein the panel comprises AIMs set forth as
SEQ ID NOS:1 to 71.

6. (Original) The method of claim 3, wherein the panel comprises AIMs set forth as:
SEQ ID NOS:7, 21, 23, 27, 45, 54, 59, 63, and 72 to 152;
SEQ ID NOS:3, 8, 9, 11, 12, 33, 40, 59, 63, and 153 to 239;
SEQ ID NOS:1, 8, 11, 21, 24, 40, 172, and 240 to 331; or
combinations thereof.

7. (Cancelled)

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8. (Original) The method of claim 3, wherein the BGA comprises a proportion of a sub-Saharan African, Native American, IndoEuropean, or East Asian ancestral group, or a combination of said ancestral groups.

9. (Original) The method of claim 8, wherein the BGA comprises a proportion of at least three ancestral groups.

10 and 11. (Cancelled)

12. (Original) The method of claim 1, wherein the trait comprises responsiveness of the individual to a drug.

13 and 14. (Cancelled)

15. (Original) The method of claim 1, wherein the trait comprises susceptibility to a disease.

16. (Original) The method of claim 15, wherein the disease has an ethnic predisposition.

17 to 20. (Cancelled)

21. (Original) The method of claim 15, wherein the disease is alcoholism.

22. (Original) The method of claim 1, wherein the trait comprises a pigmentation trait.

23. (Cancelled)

24. (Currently Amended) The method of claim 1, further comprising identifying, ~~with a predetermined level of confidence,~~ a sub-population structure of the population structure indicated by that correlates with the nucleotide occurrences of the AIMs-SNPs detected in the test individual in step a), wherein the sub-population structure ~~correlates~~ infers with a the trait.

25 to 28. (Cancelled)

29. (Original) The method of claim 1, which is performed in a high throughput format.

30. (Original) The method of claim 1, which is performed in a multiplex format.

31. (Currently Amended) A method of estimating, ~~with a predetermined level of confidence,~~ proportional ancestry of at least two ancestral groups of an individual, comprising:

a) ~~contacting-detecting, in a nucleic acid sample from a sample comprising nucleic acid molecules of an test individual, with hybridizing oligonucleotides,~~
~~wherein the hybridizing oligonucleotides can detect~~ nucleotide occurrences of single nucleotide polymorphisms (SNPs) ~~of in~~ a panel of at least about ten ancestry informative markers (AIMs), wherein the nucleotide occurrences of the SNPs are indicative of a population structure, wherein the population structure is correlated with biogeographical ancestry (BGA) for each of the at least two ancestral groups, and wherein the panel comprises at least one AIM that is not linked to a gene linked to BGA examined, and

~~wherein said contacting is under conditions suitable for detecting the nucleotide occurrences of the AIMs of the test individual by the hybridizing oligonucleotides; and~~

b) ~~identifying, with a predetermined level of confidence, a~~ the population structure ~~that correlates indicated by~~ with the nucleotide occurrences of the ~~AIMs SNPs of~~ each of the ancestral groups ~~examined detected in the individual of step a)~~, wherein ~~identifying the population structure is indicative estimates of~~ proportional ancestry, thereby estimating, ~~with a predetermined level of confidence,~~ proportional ancestry of the individual.

32. (Original) The method of claim 31, wherein the proportional ancestry comprises a proportion of a sub-Saharan African ancestral group, a Native American ancestral group, an IndoEuropean ancestral group, an East Asian ancestral group, or a combination thereof.

33 to 36. (Cancelled)

37. (Original) The method of claim 31, wherein the panel for at least one of the ancestral groups comprises AIMs set forth as:

SEQ ID NOS:7, 21, 23, 27, 45, 54, 59, 63, and 72 to 152;

SEQ ID NOS:3, 8, 9, 11, 12, 33, 40, 59, 63, and 153 to 239;

SEQ ID NOS:1, 8, 11, 21, 24, 40, 172, and 240 to 331; or

combinations thereof.

38. (Cancelled)

39. (Currently Amended) The method of claim 31, wherein the proportional ancestry comprises proportions of three ancestral groups, and

wherein identifying ~~a~~ the population structure ~~that correlates with~~ indicated by the nucleotide occurrences of the ~~AIMs SNPs of the test individual of step a)~~ comprises:

performing a likelihood determination for affiliation with each of a sub-Saharan African ancestral group, a Native American ancestral group, an IndoEuropean ancestral group, and an East Asian ancestral group;

thereafter selecting three ancestral groups having a greatest likelihood value;

determining a likelihood of all possible proportional affiliations among the three ancestral groups having the greatest likelihood value, whereby a population structure ~~or proportional affiliation~~ that correlates with the nucleotide occurrences of the AIMs-SNPs of the test-individual is identified; and

identifying a single proportional combination of maximum likelihood, thereby estimating the proportional ancestry of the individual.

40. (Currently Amended) The method of claim 31, wherein the proportional ancestry comprises proportions of three ancestral groups, and wherein identifying a population structure ~~that correlates with~~ indicated by the nucleotide occurrences of the AIMs-SNPs comprises:

performing six two-way comparisons comprising likelihood determinations for affiliation between each group with each other group;

thereafter selecting three ancestral groups having a greatest likelihood value;

determining a likelihood of all possible proportional affiliations among the three ancestral groups having the greatest likelihood value, whereby a population structure ~~or proportional affiliation~~ that correlates with the nucleotide occurrences of the AIMs-SNPs of the test-individual is identified; and

identifying a single proportional combination of maximum likelihood, thereby estimating the proportional ancestry of the individual.

41. (Currently Amended) The method of claim 31, wherein the proportional ancestry comprises proportions of three ancestral groups, and

wherein identifying a the population structure that correlates with indicated by the
nucleotide occurrences of the AIMs-SNPs of the test individual of step a) comprises:

performing three three-way comparisons among the groups,

determining a likelihood of all possible proportional affiliations among the three ancestral
groups having the greatest likelihood value, whereby a population structure ~~or proportional~~
~~affiliation~~ that correlates with the nucleotide occurrences of the AIMs-SNPs of the test individual
is identified; and

identifying a single proportional combination of maximum likelihood, thereby estimating
the proportional ancestry of the individual.

42. (Currently Amended) The method of claim 31, wherein the proportional ancestry
comprises proportions of four ancestral groups, and

wherein identifying a the population structure that correlates with indicated by the
nucleotide occurrences of the AIMs-SNPs of the test individual of step a) comprises performing
six two-way comparisons, three three-way comparisons, or one four-way comparison among the
four ancestral groups;

determining a likelihood of all possible proportional affiliations among the four ancestral
groups having the greatest likelihood value, whereby a population structure ~~or proportional~~
~~affiliation~~ that correlates with the nucleotide occurrences of the AIMs-SNPs of the test individual
is identified; and

identifying a single proportional combination of maximum likelihood, thereby estimating
the proportional ancestry of the individual.

43. (Original) The method of claim 40, further comprising generating a graphical
representation of the comparison of the three ancestral groups, said graphical representation
comprising a triangle with each ~~an~~ ancestral group independently represented by a vertex of the

triangle, wherein the maximum likelihood value of proportional affiliation for an individual comprises a point within the triangle.

44. (Original) The method of claim 43, wherein the graphical representation further comprises a confidence contour indicating a level of confidence associated with estimating the proportional ancestry.

45. (Currently Amended) The method of claim 31, further comprising identifying, ~~with a predetermined level of confidence,~~ a sub-population structure of the population structure ~~that correlates indicated by~~ with the nucleotide occurrences of the AIMs in the test individual, wherein the sub-population structure ~~correlates~~ infers ~~with~~ ethnicity of the test individual.

46. (Cancelled)

47. (Original) The method of claim 45, wherein the ancestral group is IndoEuropean, and wherein the ethnicity comprises Northern European or Mediterranean.

48. (Currently Amended) The method of claim 31, further comprising generating an ancestral map of the world, wherein locations of populations having a proportional ancestry corresponding to the proportional ancestry of the ~~test~~ individual are indicated on the ancestral map.

49. (Original) The method of claim 48, further comprising
- a) overlaying the ancestral map with a genealogical map, wherein the genealogical map indicates locations of populations having geopolitical relevance with respect to the test individual, and
 - b) statistically combining the information of the ancestral map and genealogical map to obtain a most likely estimate of family history of the test individual.

50. (Currently Amended) The method of claim 31, wherein identifying a population structure ~~that correlates with~~ indicated by the nucleotide occurrences of the AIMs SNPs detected in the individual of step a) comprises comparing the nucleotide occurrences of the AIMs-SNPs of the test individual with known proportional ancestries corresponding to nucleotide occurrences of AIMs-SNPs indicative of BGA.

51. (Currently Amended) The method of claim 50, wherein the known proportional ancestries corresponding to nucleotide occurrences of AIMs-SNPs indicative of BGA are contained in a database.

52. (Original) The method of claim 51, wherein the comparing is performed using a computer.

53. (Currently Amended) The method of claim 50, wherein each of the known proportional ancestries corresponding to nucleotide occurrences of AIMs-SNPs indicative of BGA further comprises ~~of~~ at least one photograph of a person from whom the known proportional ancestry was determined.

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54. (Currently Amended) The method of claim 53, wherein the at least one photograph comprises a digital photograph.

55. (Original) The method of claim 54, wherein digital information comprising the digital photograph is contained in a database.

56. (Currently Amended) The method of claim 55, wherein the digital information in the database is associated with ~~a~~the known proportional ancestry corresponding to nucleotide occurrences of ~~AIMs~~SNPs indicative of BGA of the person in the photograph.

57. (Currently Amended) The method of claim 51, further comprising identifying at least one photograph of a person having a proportional ancestry corresponding to the proportional ancestry of the ~~test~~ individual.

58. (Original) The method of claim 57, wherein identifying the photograph comprises scanning a database comprising a plurality of files, each file comprising digital information corresponding to a digital photograph of a person having a known proportional ancestry, and identifying at least one photograph of a person having nucleotide occurrences of AIMs indicative of BGA that correspond to the nucleotide occurrences of AIMs indicative of BGA of the test individual.

59-82 (Cancelled)